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Genesis of a Vertical City in Hong Kong

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Abstract

A vertical city with multifunctional land use turns out to be the most viable solution for an urban condition characterized by increasing density due to population expansion, topographical limitation of buildable land, economic development and the pursuit for collective sustainable living, such as in Hong Kong. This paper presents initial research results from a study on the chronological and typological evolution of tall buildings in the city, from the climate-responsive verandah typology to the mixed-use hyper-commercial podium and residential tower typologies that predominate today, to the ultimate formation of a vertical city. Case studies and surveys have focused on the development of this building typology throughout the decades since the 1920s, substantiating a discussion on the subjective and objective factors contributing to a genesis of the vertical city phenomenon in Hong Kong. The discussion will engage, under the notion of the vertical city, on how residents and visitors adapt to the growing density of the city, and how they accustom themselves to the changing urban morphology over time. Advantages such as high efficiency, spaces savings, time convenience, etc.; and disadvantages such as deficiency in livability, incompatibility of uses, environmental health deficiencies, etc.; serve as a reference for other cities in need of high-density planning due to population and economic growth.

Keywords: Vertical city, Density, Hong Kong, Mixed land use, Building typology

1. Introduction

Compared with other global cities, the unique status of Hong Kong as a vertical city represents a complex and multifunctional combination of extremely high density and unprecedented scale at the building and urban level. Hyperdensity, vertically mixed land use, multifunctional and integrated development, land preservation, environmental sustainability and large scale constitute the main characteristics of Hong Kong as a vertical city. The genesis of the vertical city of Hong Kong can be traced back to the early 20th Century. Since then, the city has grown gradually to become a vertical city, due to various subjective and objective factors, such as a population explosion in a relatively short time, the topographical limitations of hilly and coastal terrain, economic development and the pursuit of sustainable living for its populace. The building typologies can be divided chronologically as the verandah-type shop houses before the 1940s, the cantilevered living quarters of the 1950s, the sloped-setback typology in the 1960s, the block typology in the 1970s, the podium tower typology in the 1980s, the "hyperpodium" tower in the 1990s, and the super high-rise podium tower typology, prevalent since 2000 (see Figs. 1, 2).

2. Characteristics of Hong Kong as a Vertical City

2.1. High Density Shapes the City

The development of Hong Kong planning and its physical features may be referenced to urban planning theories and experiments such as the "Berlin Project" by Smithson, the "Toulouse Project" by Candilis; the "Plug-In City" and the "Instant City" by Archigram; the "Citta Nuova" by Sant'Elia and Chiattone (Nakamura, 1992). The anonymity of individual buildings increases as the urban area evolves into a distinct form, referred to by many critics as nothing but a "concrete forest." Hong Kong's population density is has ranked fourth among all countries or dependent territories. Considering that only 24.1% of its total land mass had been urbanized and developed by the end of 2013[1], its urbanized areas present the world's highest population density.

2.2. Vertically Mixed Land Use and Multifunctional Development

Urban morphology is the study of the physical form of a city, considering the street patterns, building sizes and shapes, architectural styles, population density and patterns

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[1]The data on land usage is from the official website of Planning Department of the Government of Hong Kong Special Administrative Region. http://www.pland.gov.hk/pland_en/info_serv/statistics/landu.html

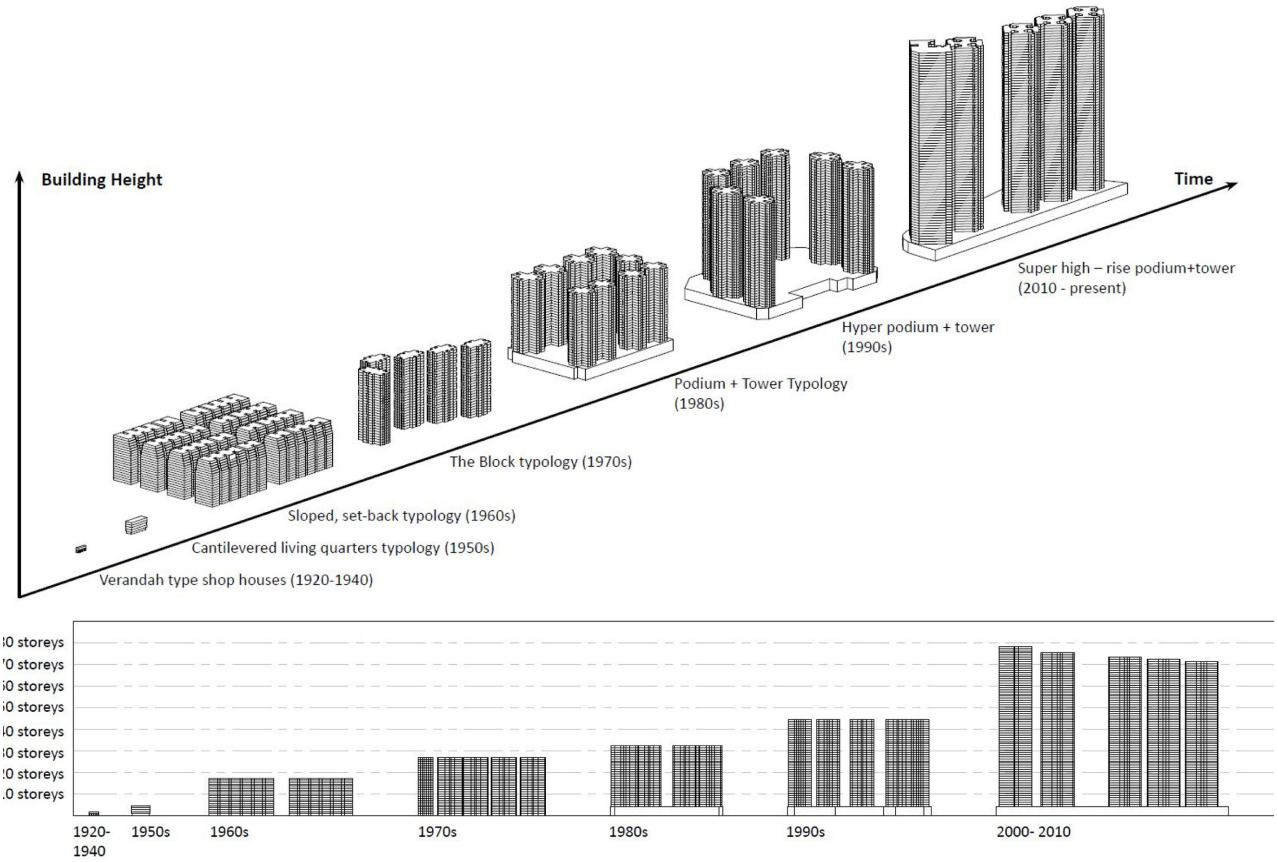


Figure 1 & 2. Genesis and evolution of a vertical city in Hong Kong.

of residential, commercial, industrial and other uses, among other things (Lau, 2011). Hong Kong's urban morphology combines two compatible - if seemingly opposed-systems, integration and segregation (Lau & Coorey, 2007). The local building ordinance is such that mixed land use and vertical integration are widely applicable to both private and public development. The phenomenon of integrated and multifunctional land use optimizes the accessibility, vitality, and efficiency of building complexes as well as the community they serve. The public can live, work, shop and relax in close proximity. The range of daily activities, in some circumstances, can be undertaken entirely within a single vertical complex.

On the other hand, the multifunctional and intensive land use in Hong Kong is generally segregated vertically where residences and commercial usage are concerned. The unique "podium system" is a main feature of Hong Kong's building design paradigm for mixed land use, which separates almost all skyscrapers into two parts: at the base is a 50-foot- / 15-meter- podium, and above the podium is the tower. The podiums are used for mixed functions apart from residences, which are always apportioned to the towers. Such segregation is derived from the consideration of security and privacy issues for residents in the towers mixing with the commercial land use in the podium underneath the towers.

2.3. Enjoying more Sustainability than Livability

Hong Kong is a city renowned for its environmental sustainability, as it has preserved in its natural state more than 75% of its overall area, which includes 24% woodland, 24.2% shrubland and 18.3% grassland[2]. By doing so, Hong Kong has made its urban area extremely centralized, compact and populated, which has achieved a tradeoff between sustainability and livability for its citizens. Without urban sprawl, the city grows increasingly higher to accommodate positive population growth. As a result, the public has no choice but to adapt to an overcrowded living environment with less open space, deficiency in greenery, a lack of privacy and a high incidence of noise disturbance at the community level. While Hong Kong has a high esteem for its environmental footprint, it also suffers in the world rankings of livable cities due to the above condition. Obviously, there is a lot to be done

[2]The land cover data is from the official website of Planning Department of the Government of Hong Kong Special Administrative Region, which was updated at the end of 2013. http://www.pland.gov.hk/pland_en/info_serv/statistics/landu.html

concerning the relief of urban stresses due to adverse microclimates, air quality, noise, lack of daylight, and paucity of open spaces and greenery in the inner city.

2.4. Scale and Scope: City within a City

In Hong Kong, vertical living at a high density is found not just at the neighborhood scale, but rather at a metropolitan scale. At a conceptual level, Hong Kong is composed of numerous vertical cities at different scales. It is a megacity without urban sprawl, and its urban functions are highly centralized and intensively mixed within almost all the built-up areas. For example, as 100% coverage of the ground floor is allowed in podium design, Hong Kong's unique practices of a vertical city in such a large scale has made itself a hyper-dense city, in which large floor-area ratios can be achieved (Ohno, 1992).

2.5. Privacy versus Anonymity and Homogeneity

Living in a vertical city sculpted by a compact development strategy means that there are inevitably more households and users per unit area. The boundary of different urban functions is hard to define, and the relationship between public and private activities is to some extent vague. Lack of privacy is often regarded as one of the disadvantages of a vertical city with high density. However, only when distinct boundaries are broken, attractive and dynamic urban life is possible, which is also the charm of compact urban life in Hong Kong (Kojima, 1992). Besides, the high density and numerous dwelling units of skyscrapers create an atmosphere of anonymity. People go to work or home by entering the elevators, immediately entering a "blurred zone," as they disappear into the "camouflage" of the tall buildings provided by their homogeneity.

3. Genesis and Evolution of a Vertical City

3.1. Verandah-Type Shop Houses (1920-1940)

The verandah type of vertical mixed-use buildings for residential and commercial purposes widely existed in Hong Kong before the 1950s (see Fig. 3). Those two- to four-story houses had substantial overhangs, with the enclosed verandahs sitting on pillars above the street or pavements below. The traditional "*sotto portico*" space is significant for social and cultural communication. The ground floor was in general used as a commercial space, while the upper stories were used as residential space. Thus the verandah-type buildings with colonnades represent early example of multifunctional vertical land use in Hong Kong. Today, very few of these kind of historic buildings can be found in Hong Kong. A rare example exists in the buildings at Nos. 600-626 Shanghai Street (see Fig. 4). These portray a typology commonly associated with the international community of settlers and traders in the Southeast Asia during the colonial period. The verandah typology is a direct response to climate, devised to afford

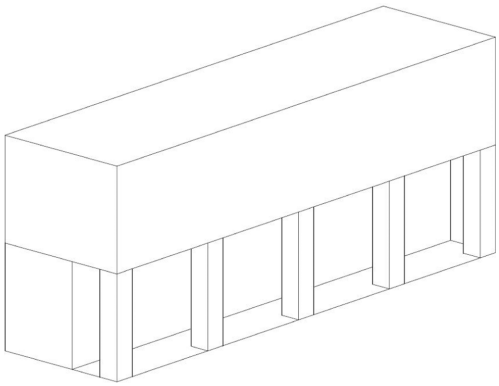


Figure 3. Verandah-type shop houses.



Figure 4. Shanghai Street in the early 1900s (Source: Street studies in Hong Kong: localities in a Chinese city).

building users a mild and tolerable indoor environment. The typology is typically a mixed land-use family house with high ceilings (for air ventilation), on the first story and above, with a shop on the ground floor. The verandah is clearly designed to protect the domestic residents on the upper floor, while also providing shading from weather (sun and rain) for shop customers on the ground floor. The verandah is an effective device as a street connector, as it forms a covered street or shopping arcade.

3.2. Cantilevered Living Quarters Typology (1950s)

The population of Hong Kong increased dramatically after the Second World War because of the influx of immigrants from Mainland China, and the increase in economic activity, leading to the need for high-density living (Lau & Coorey, 2007). Due to the housing shortage problem caused by refugee/immigrant influxes and economic activity, the buildable floor-area ratio was raised in the Building Ordinance of 1956 in order to facilitate more and larger residential buildings. Accordingly, new features and building typologies emerged after the Second World War, when the city saw five- or six-story, single-staircase shop houses targeting multiple families. The appellation "Cantilevered living quarter" refers to the new provision in the revised building ordinance of 1956 that allows the

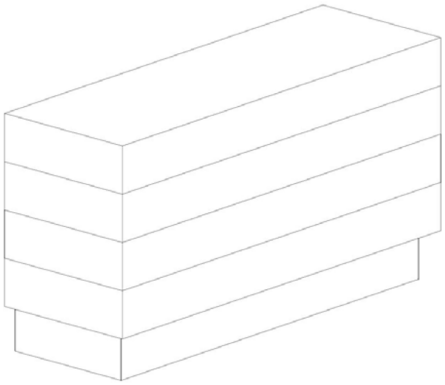


Figure 5. Cantilevered living quarters typology.

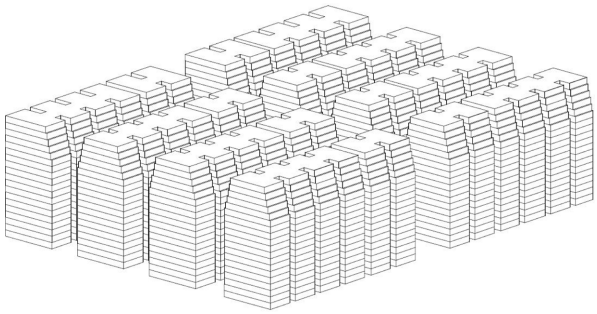


Figure 6. Sloped, set-back typology.

protrusion of residential use (as a balcony) over public land (i.e., the pavement or sidewalk), with a premium payable known as "Rent for Borrowed Space". Because the protrusion cantilevered over the pavement, columns were no longer necessary. This led to the disappearance of the colonnade arcade seen in the prior period. On the other hand, the residential floors could now gain more usable area above the pedestrian pavement, while the cantilevered balconies offered some degree of sun shading and rain protection for the street users (see Fig. 5).

3.3. Sloped, Set-Back Typology (1960s)

The Building (Planning) Regulation nos. 20, 20A and the First Schedule, which have been in force since 1962, granted a permissible site coverage of 100% at the podium up to 50 feet /15 meters above grade, with an exclusion for residential construction (Wong, 2014). This building code generated a far-reaching influence on the Hong Kong building typology, supported by the commercially available and affordable technology of elevators. These combined to make in the 1960s, making working and/or living in a high-rise building feasible. In no time, the 5- or 6-story "tower" blocks of the 1950s were redeveloped into 8- or 9-story blocks during the 1960s. Critics attributed the vertical expansion to the influences of British post-war New Towns, as well as Le Corbusier's idea of the future city, *La Ville Radieuse*.

As the buildings rose taller, the Authority set regulations to ensure a modicum of solar exposure for the units. Sunlight cut-off angles were being introduced to guarantee daylight availability at street level. As a result, one could find many tall buildings with sloped setbacks in their upper reaches (see Fig. 6). For instance, the Man Wah Sun Chuen building (文华新村)(see Fig. 7), built between 1964 and 1970, is an exemplifier of the effect of such control on the new building typology. In the Building (Planning) Regulations of 1956 (Hong Kong Government, 1956), Clause 18 stated, "Above the permitted heights of walls fronting on streets, the building above these levels shall be set back within an angle of 76 degrees to the



Figure 7. Man Wah Sun Chuen (Source: http://en.wikipedia.org/wiki/Man_Wah_Sun_Chuen).

horizontal" (Wong, 2014). The same restriction was dropped in the next phase of the Hong Kong height, when the government decided to abort the 76-degree sun-angle restriction. This released nearly all constraints on how a building could project itself into the sky. In a subtropical climate and geographic location such as Hong Kong's, where annual sun availability is considerably high, this policy reckons that solar access is a tradable commodity that can be exchanged for height gains.

3.4. The Block Typology (1970s)

The practical reason for accepting a high-density approach in Hong Kong took place in the 1970s, when about 400,000 illegal immigrants entered the territory from China and posed an immediate stress on the 10-year housing program and policies (Lau & Coorey, 2007). In the 1970s, "hyper blocks" (see Fig. 8), large rectangular masses that formed huge walls in Hong Kong nevertheless achieved the purpose of providing more dwelling units quickly to accommodate exodus of refugees from the Chinese border. The massiveness of the buildings and their close proximity compromised the provision of natural ventilation, giving rise to a demand for air conditioning by apartment dwellers from this point forward. The Mei Fu Sun Chuen (美孚新村) or the Chi Fu Fa Yuen (置富花园) (see Fig. 9) were typical precedents of this typology, and laid the foun-

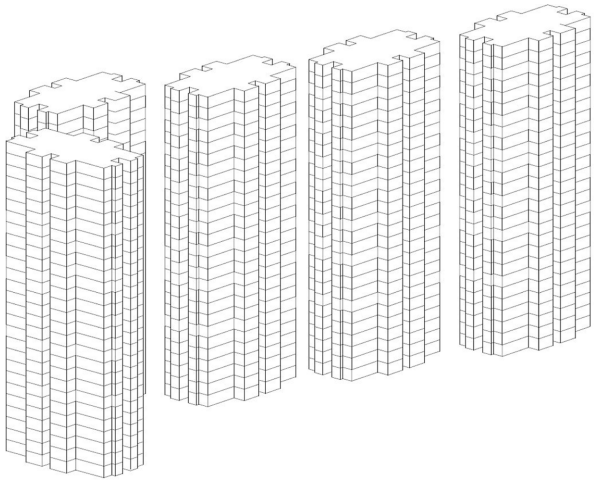


Figure 8. The block typology.



Figure 9. Chi Fu Fa Yuen (Source: http://en.wikipedia.org/wiki/Pok_Fu_Lam).

dation for a predominately vertical city. Planned along the Corbusier's ideology of the Future City, the hyper blocks were planned to combine multiple residences, commercial enterprises, restaurants, bus stations, parking lots, and communal facilities such as schools and sports areas into a single building. As the concept became popular, the developments grew in size, scale and height. In effect, each development did become "a city within the city."

3.5. Podium + Tower Typology (1980s)

The 15m/50ft full-lot-coverage was a revolution in Hong Kong's architecture design and planning language, representing the evolution of a 'Hong Kong Typology". The Hong Kong typology refers to a podium + tower type (see Fig. 10) has been generally adopted by the developers since 1980s, and while the volume of the podium has become larger and the heights of the towers higher, the basic form of this building type remains unchanged today. The podium + tower type was regarded as the unique example of vertical and multifunctional land-use practice, which created the elevated or artificial ground floor, maximizing the use of the podium roof area, and separating pedestrians and vehicles at different levels (see Fig. 11). These two parallel systems demonstrated the possibility of stratification by means of verticality. The Horizon Garden in Taikoo Shing (太古城), with 26 stories, (see Fig. 12) is a classic example of this typology from the 1980s.

3.6. Hyper Podium + Tower (1990s)

The podium + tower typology of high-rise buildings was continually being adopted in the 1990s all over China,

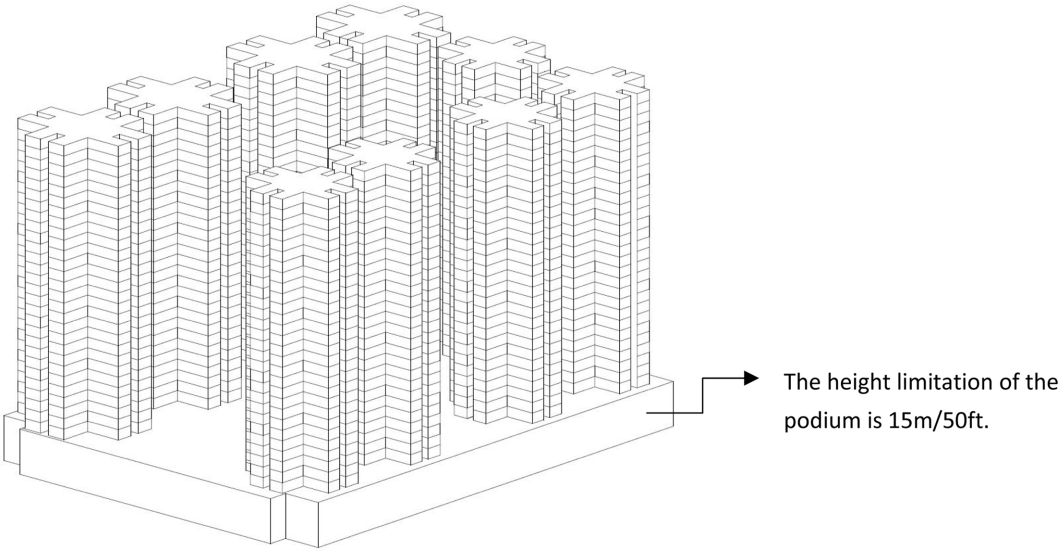


Figure 10. Podium + tower typology.

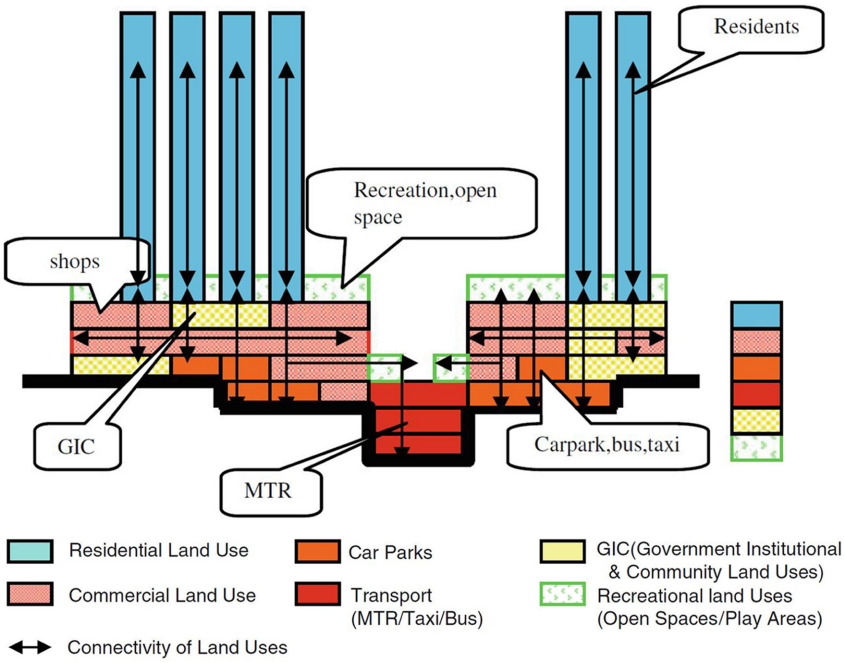


Figure 11. an example of vertical and multifunctional land use practice in Hong Kong (Source: MILUnet: Multi functional intensive Land use - Principle, practices, projects, policies - Towards sustainable area development. Habiforum Foundation, The Netherlands. p. 124.).



Figure 12. Taikoo Shing in the 1980s (Source: http://en.wikipedia.org/wiki/Taikoo_Shing).



Figure 13. Hyper podium + tower typology.

as Chinese cities underwent rapid redevelopment, and sought new development potential for newly available land. As population kept rising, the hyper podium + towers (see Fig. 13) appeared in a large number everywhere in Hong Kong and the major Chinese cities such as Guangzhou, Shanghai and Beijing. The number of stories is often above 30. East Point City (see Fig. 14) is typical of this typology.

3.7. Super High-Rise Podium + Tower (2000-2010)

In the new millennium, with the increasing volume of the podium, the heights of towers also kept increasing beyond 40 stories (see Fig. 15). At the same time, an integrative development approach gained more popularity and the vertical system became more synergistic. In the 2000s, the Sorrento (擎天半岛) at the Union Square Development (see Fig. 16) is a part of a vertical city development planned on top of the Kowloon Subway Station (since 1998). It has drawn attention due to its hyper density and its integrative approach with commercial, residential, social and



Figure 14. The East Point City (Source: http://zh.wikipedia.org/wiki/%E6%9D%B1%E6%B8%AF%E5%9F%8E).

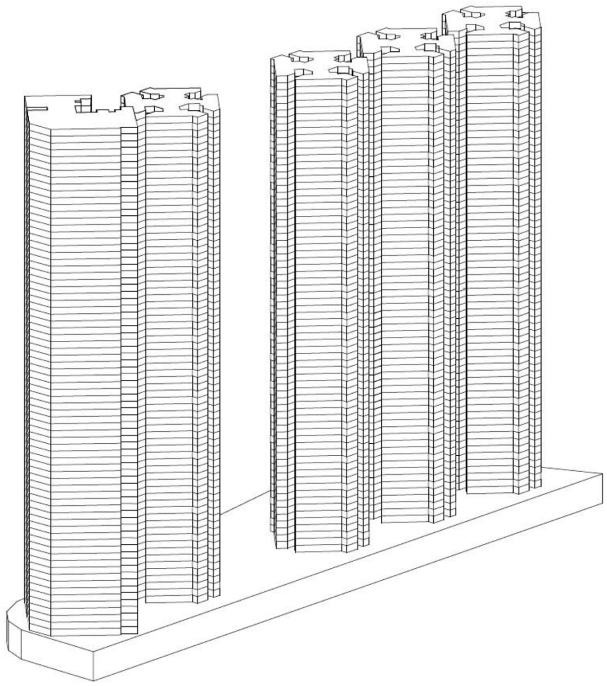


Figure 15. The Super high-rise podium + tower typology.

infrastructures of the Union Square-Kowloon MTR network. The highest residential tower of Sorrento reached 256 meters and 74 floors, while even the lowest tower of the five in total reaches 206 meters and 67 floors. The eagerness for householders to live higher, in pursuit of a marvelous harbor view, has pushed market demand for super high-rise development at all fronts in Hong Kong in the post-1997 era.

3.8. Super High-Rise Podium + Tower (2010~Present)

Since 2010, the "Sky is the limit" milestone is being challenged as every new development seeks to be higher, taller and bigger. Building heights are still gradually increasing, as Hong Kong's vertical city policy continues.



Figure 16. The Union Square Development (Source: http://en.wikipedia.org/wiki/Union_Square_(Hong_Kong)).

4. Discussion

4.1. The Contributing Factors of a Vertical City

Subjective and objective factors: In Hong Kong, the objective factors are firstly the topographical limitations of hilly and coastal terrain, which provide limited economically viable flatlands for developing a metropolis. The same limitation also ruled out sprawl. Instead, the city has embarked on a path towards three-dimensional form-making, deriving the highest efficiency from vertical spatial organization.

Secondly, the population influx from Mainland China, and those immigrants attracted by Hong Kong's strategic economic status, have given rise to an ever-increasing demand for housing and support infrastructure.

Hong Kong's economic engines are light industry and commerce, which are quite compatible with other urban functions and do not need to be separated from the downtown area in the planning process. In the formative era prior to the 1980s, when the territory did not have a formal planning department, it made for an informal, "plan as one goes" market-driven planning atmosphere conduc-

tive to mixed land-use development.

On the other hand, there are quite a few subjective factors driving this brand of vertical urbanism. The Government of Hong Kong has reserved preservation lands as a conscious development strategy, rendering more than three fourths of the area of Hong Kong un-built. For the remainder, the building ordinance encourages the widespread urban form of the podium and tower, and accommodates both idioms of preserving nature, and building densely and tall. On the other hand, this created a vertical city syndrome bookended by superlatives - the greenest city footprint on the one hand, and the most dense and tall, compact city on the other. The acceptance and adaption by citizens represents a tradeoff between the efficiency, convenience and proximity created by a vertical city. In this place, one can gain access to almost everything in a span of minutes, on foot or via mass transit, through many different modes.

Throughout the past decades, the public showed a tolerance for the adverse spatial compaction and lack of open space, until the emergence of environmentalist concerns about deficiencies in quality of life. Government agencies have chosen to impose restrictions on building height, and have introduced other planning restrictions. These include provisions for breaking up the "screen" effect produced by the nearly unbroken, linear façade walls of tall buildings in tight groups, which block air movement and solar access in the city. The solution has been to set these monsters back from existing urban streets, to create a wider street canyon for air, wind and daylight; the deployment of landscaping and greenery in every new development has also improved conditions.

4.2. Advantages and Disadvantages of a Vertical City

The advantages of a vertical city lie in compact development and intensely mixed land use, yielding high efficiency, land conservation, better public transportation and walkability for urban living. An interview conducted in 2001 indicated that the majority of residents who live in high-rise apartments preferred to live on higher floors, primarily for the enjoyment of better views and fresh air, despite having to pay a higher rent or purchase price (Lau et al., 2005). The pedestrian activity that takes place at the ground level is also replicated on a separate, elevated deck, supplemented with shops and greenery, thereby reducing health risks from vehicular fumes, noise and pollution (Lau & Martinez, 2012). The vertical city practice in Hong Kong has explored a feasible solution to relieve this conflict, by introducing an elevated or artificial "ground floor" on the upper floors, right up to the roof of the podium, for shoppers, commuters and residents alike. This practice has become the norm for huge developments, particularly those in the satellite new towns, where the ground plane is reserved for public transport interchange.

The disadvantages of a vertical city are mainly manifested in deficiencies in livability, incompatibility of uses due to lack of integrative planning, shortage of open space, lack of greenery, and invasion of privacy. The border of private life and pubic activities blur to obscurity.

Another problem is the urban heat island effect, which is the temperature difference between urbanized and its surrounding undeveloped areas (Oke, 1987). Many Asian megacities suffer from the environmental and energy issues presented by the heat island effect, especially when a vertical city will amplify the adverse effect due to its intense land use and high concentration of human activity.

4.3. Transitioning from Horizontal to Vertical Living

Surveys (Lau et al., 2009) shown that within the constraint of the vertical city, most residents are willing to adapt to the growing density of the city and can grow accustomed to the dramatic urban morphology. The convenience created by mixed use might make up to some extent for the drawbacks created by an overcrowded urban living environment. In Hong Kong, the public tends to compromise as per-capita resources are reduced gradually. The residents' tolerance and forgiveness towards lack of privacy, greenery, open spaces, natural ventilation, sunshine and narrowed living space pay for the high efficiency, accessibility, vitality, efficacy of compact living at height. Still, recent years have seen a growing pushback from certain citizen groups, which has driven a heated debate on questions like, "How tall may one build a city? Have we finally reached the upper vertical limit of growth?"

4.4. Experiences and Lessons of Vertical Development in Hong Kong

Hong Kong's experience with vertical living serves as a reference for other cities. First, the lack of natural ventilation in urban areas is a common adverse situation in Hong Kong, especially at the lower levels, because of the high density of skyscrapers forming canyon-like conditions. Disease control and prevention is another issue for a vertical city with high density, which could be more serious due to poor ventilation.

For example, when SARS manifested in Hong Kong in 2001, the epidemic situation became harder to control because of the cross infection due to high population density.

Besides disease, fire control should be paid more attention in developing a vertical city. In case of fire, evacuation and rescue are inevitably harder for a vertical city as height increases. Safety, both physiological and psychological, for the residents should be given priority.

Furthermore, Hong Kong has paid the price for developing a vertical city, which should serve as a warning to its followers. High - rise buildings face the pressing complaints of poor air quality, ventilation, daylight, lack of open space and noise pollution (Lau, 2011). The vertical city followers should pay attention to maintaining a balance between sustainability and livability. In recent years, the term of vertical garden city has gained popularity and

seen as a positive means to harmonize both sides of the argument.

The Hong Kong experience has indicated that building ordinances should respond to the challenges presented by high density and mixed land use. If a government is planning to build a vertical city, supportive policies should be reviewed and enhanced on a regular basis, such as reducing the limitations of land use, enforcing strict laws on skyscrapers, integrating governmental functions like housing, transportation, infrastructure and greenery, carrying out fire drill and proper planning for the threat of a pandemic situation. The vertical city practice in Hong Kong has also shown that, only when the land use is of high efficiency and the urban activities are centralized, is there the possibility for the public transport system to be effective and profit-generating.

The successful experience and model of Hong Kong's MTR system, which is regarded as one of the world's leading railways, carries an average of 5.1 million passengers every weekday. It relies on Hong Kong's extremely high density of living. Recent years saw the Hong Kong MTR bring in a substantial net profit, which is extremely rare for a public transportation agency.

The integrative approach to develop the public transport system of Hong Kong presents a unique case for discussion. Hong Kong's MTR Corporation integrated its railway systems, residential development, official buildings, retails and infrastructure as a whole. There is a vertical city above each station, and each station serves the particular residents of the vertical city above it. Moreover, integrative thinking and synergic approaches, taken during the planning stage, are needed to avoid functional incompatibility.

Finally, contextualizing the practices and experiences from Hong Kong is significant for other cities that are trying to create vertical cities.

5. Conclusion

From the genesis of Hong Kong's vertical city, it can be seen that vertical expansion is one of the solutions to accommodate population demand, land preservation constraints and urban efifciency. Hong Kong is in some senses an outlier, one that is quite obsessed with hyper density. It is nonetheless a useful specimen for academics, professionals, officials and decision makers of other cities to study.

References

Hong Kong Government. (1956). Building (Planning) Regulations, The Hong Kong Government Gazette, Supplement No. 2.

Kojima, K. (1992). Hyper-dense Market City: A Metropolis for the People. *SD space Design*, 3, pp. 65~67.

Lau, S. S. Y. (2011). Physical Environment of Tall Residential Buildings: The Case of Hong Kong (pp. 25~47). Dordrecht: Springer Netherlands.

Lau, S. S. Y. & Coorey, S. (2007). Hong Kong: MILU and how it is perceived. *MILUnet: Multi functional intensive land use – Principle, practices, projects, policies – Towards sustainable area development. Harbiforum Foundation, The Netherlands*.

Lau, S. S. Y., Giridharan, R., & Ganesan, S. (2005). Multiple and intensive land use: case studies in Hong Kong. *Habitat International*, 29(3), pp. 527~546. doi:10.1016/j.habitatint.2004.04.007

Lau, S. S. Y. & Martinez, G. (2012). Sustainable: the urban model based on high-density, high-rise and multiple, intensive land use: the case of Hong Kong. *Architecture, City and Environment,* 7(20), pp. 81~94.

Leeming, F. (1977). *Street studies in hong kong: Localities in a chinese city.* New York; Hong Kong: Oxford University Press.

Nakamura, K. (1992). Super Modernism: Its Fiction and Stratification. *SD space Design*, 3, pp. 73~75.

Ohno, H. (1992). Hongkong: Alternative Metropolis. *SD space Design*, 3, pp. 76~77.

Oke, T. R. (1987). *Boundary layer climates*. London: Methuen & Co.

Wong, W. S. (2014). Architectural Phenomena Following Law-Review of Residential Buildings in Hong Kong's Colonial Era. *Journal of Civil Engineering and Architecture Research*, 1(4), pp. 215~229.